```
R version 4.2.2 (2022-10-31 ucrt) -- "Innocent and Trusting"
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Platform: x86_64-w64-mingw32/x64 (64-bit)

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  Natural language support but running in an English locale

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[Previously saved workspace restored]

> #code to calculate MOM and MLE
> Calculate_MLE_MOM <- function(n, theta) {
+   Sample = runif(n, min=0, max=theta)
+   MOM_Esti = 2*mean(Sample)
+   MLE_Esti = max(Sample)
+   return(c(MLE_Esti,MOM_Esti))
+ }
>
> #code to calculate the MSE
> MSE_Esti = function(n, theta) {
+   estimate = replicate(1000, Calculate_MLE_MOM(n, theta))
+   estimate = (estimate - theta)^2
+   estimate.MOM_Esti = estimate[c(TRUE, FALSE)]
+   estimate.MLE_Esti = estimate[c(FALSE, TRUE)]
+   return(c(mean(estimate.MLE_Esti),mean(estimate.MOM_Esti)))
+ }
>
> MSE_Esti(1,1)
[1] 0.3201728 0.3298294
> MSE_Esti(1,5)
[1] 8.423618 8.384768
> MSE_Esti(1,50)
[1] 803.9149 833.4034
> MSE_Esti(1,100)
[1] 3357.645 3238.024
> MSE_Esti(2,1)
[1] 0.1778052 0.1753118
> MSE_Esti(2,5)
[1] 4.172489 4.345351
> MSE_Esti(2,50)
[1] 398.7583 397.9505
> MSE_Esti(2,100)
[1] 1576.274 1647.233
> MSE_Esti(3,1)
[1] 0.1133796 0.1001241
> MSE_Esti(3,5)
[1] 2.708151 2.516601
> MSE_Esti(3,50)
[1] 278.6064 249.2343
> MSE_Esti(3,100)
[1] 1147.980 1040.178
> MSE_Esti(5,1)
[1] 0.06333097 0.04568486
> MSE_Esti(5,5)
[1] 1.641226 1.133013
> MSE_Esti(5,50)
[1] 152.6647 117.7215
> MSE_Esti(5,100)
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[1] 689.3467 464.3145
> MSE_Esti(10,1)
[1] 0.03351973 0.01557688
> MSE_Esti(10,5)
[1] 0.9599630 0.4061318
> MSE_Esti(10,50)
[1] 78.56789 36.77286
> MSE_Esti(10,100)
[1] 322.3599 146.1992
> MSE_Esti(30,1)
[1] 0.010927362 0.001799196
> MSE_Esti(30,5)
[1] 0.29004884 0.04903987
> MSE_Esti(30,50)
[1] 27.104888  5.291204
> MSE_Esti(30,100)
[1] 111.88970  19.83637
> #For n = 1
> plot(c(1, 5, 50, 100),c(MSE_Esti(1,1)[1], MSE_Esti(1,5)[1], MSE_Esti(1,50)[1], MSE_Esti(1,100)[
1]), type="b", col="blue", main="For n = 1", xlab="theta", ylab="MSE")
> lines(c(1, 5, 50, 100), c(MSE_Esti(1,1)[2], MSE_Esti(1,5)[2], MSE_Esti(1,50)[2], MSE_Esti(1,100
)[2]), type="b", col="red")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("green", "blue"))
> #For n = 1
> plot(c(1, 5, 50, 100),c(MSE_Esti(1,1)[1], MSE_Esti(1,5)[1], MSE_Esti(1,50)[1], MSE_Esti(1,100)[
1]), type="b", col="blue", main="For n = 1", xlab="Theta", ylab="MSE")
> lines(c(1, 5, 50, 100), c(MSE_Esti(1,1)[2], MSE_Esti(1,5)[2], MSE_Esti(1,50)[2], MSE_Esti(1,100
)[2]), type="b", col="red")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("blue", "red"))
> #For n = 2
> plot(c(1, 5, 50, 100),c(MSE_Esti(2,1)[1], MSE_Esti(2,5)[1], MSE_Esti(2,50)[1], MSE_Esti(2,100)[
1]), type="b", col="blue", main="For n = 2", xlab="theta", ylab="MSE")
> lines(c(1, 5, 50, 100), c(MSE_Esti(2,1)[2], MSE_Esti(2,5)[2], MSE_Esti(2,50)[2], MSE_Esti(2,100
)[2]), type="b", col="red")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("blue", "red"))
> #For n = 3
> plot(c(1, 5, 50, 100),c(MSE_Esti(3,1)[1], MSE_Esti(3,5)[1], MSE_Esti(3,50)[1], MSE_Esti(3,100)[
1]), type="b", col="blue", main="For n = 3", xlab="theta", ylab="MSE")
> lines(c(1, 5, 50, 100), c(MSE_Esti(3,1)[2], MSE_Esti(3,5)[2], MSE_Esti(3,50)[2], MSE_Esti(3,100
)[2]), type="b", col="red")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("blue", "red"))
> #For n = 5
> plot(c(1, 5, 50, 100),c(MSE_Esti(5,1)[1], MSE_Esti(5,5)[1], MSE_Esti(5,50)[1], MSE_Esti(5,100)[
1]), type="b", col="blue", main="For n = 5", xlab="theta", ylab="MSE")
> lines(c(1, 5, 50, 100), c(MSE_Esti(5,1)[2], MSE_Esti(5,5)[2], MSE_Esti(5,50)[2], MSE_Esti(5,100
)[2]), type="b", col="red")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("blue", "red"))
> #For n = 10
> plot(c(1, 5, 50, 100),c(MSE_Esti(10,1)[1], MSE_Esti(10,5)[1], MSE_Esti(10,50)[1], MSE_Esti(10,1
00)[1]), type="b", col="blue", main="For n = 10", xlab="theta", ylab="MSE")
> lines(c(1, 5, 50, 100), c(MSE_Esti(10,1)[2], MSE_Esti(10,5)[2], MSE_Esti(10,50)[2], MSE_Esti(10
,100)[2]), type="b", col="red")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("blue", "red"))
> #For n = 30
> plot(c(1, 5, 50, 100),c(MSE_Esti(30,1)[1], MSE_Esti(30,5)[1], MSE_Esti(30,50)[1], MSE_Esti(30,1
00)[1]), type="b", col="blue", main="For n = 30", xlab="theta", ylab="MSE")
> lines(c(1, 5, 50, 100), c(MSE_Esti(30,1)[2], MSE_Esti(30,5)[2], MSE_Esti(30,50)[2], MSE_Esti(30
,100)[2]), type="b", col="red")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("blue", "red"))
> #For theta = 1
> plot(c(1, 2, 3, 5, 10, 30),c(MSE_Esti(1,1)[1], MSE_Esti(2,1)[1], MSE_Esti(3,1)[1], MSE_Esti(5,1
)[1], MSE_Esti(10,1)[1], MSE_Esti(30,1)[1]), type="b", col="red", main="For theta = 1", xlab="the
ta", ylab="MSE")
> lines(c(1, 2, 3, 5, 10, 30), c(MSE_Esti(1,1)[2], MSE_Esti(2,1)[2], MSE_Esti(3,1)[2], MSE_Esti(5
,1)[2], MSE_Esti(10,1)[2], MSE_Esti(30,1)[2]), type="b", col="blue")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("red", "blue"))
> #For theta = 5
> plot(c(1, 2, 3, 5, 10, 30),c(MSE_Esti(1,5)[1], MSE_Esti(2,5)[1], MSE_Esti(3,5)[1], MSE_Esti(5,5
)[1], MSE_Esti(10,5)[1], MSE_Esti(30,5)[1]), type="b", col="red", main="For theta = 5", xlab="the
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ta", ylab="MSE")
> lines(c(1, 2, 3, 5, 10, 30), c(MSE_Esti(1,5)[2], MSE_Esti(2,5)[2], MSE_Esti(3,5)[2], MSE_Esti(5
,5)[2], MSE_Esti(10,5)[2], MSE_Esti(30,5)[2]), type="b", col="blue")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("red", "blue"))
> #For theta = 50
> plot(c(1, 2, 3, 5, 10, 30),c(MSE_Esti(1,50)[1], MSE_Esti(2,50)[1], MSE_Esti(3,50)[1], MSE_Esti(
5,50)[1], MSE_Esti(10,50)[1], MSE_Esti(30,50)[1]), type="b", col="red", main="For theta = 50", xl
ab="theta", ylab="MSE")
> lines(c(1, 2, 3, 5, 10, 30), c(MSE_Esti(1,50)[2], MSE_Esti(2,50)[2], MSE_Esti(3,50)[2], MSE_Est
i(5,50)[2], MSE_Esti(10,50)[2], MSE_Esti(30,50)[2]), type="b", col="blue")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("red", "blue"))
> #For theta = 100
> plot(c(1, 2, 3, 5, 10, 30),c(MSE_Esti(1,100)[1], MSE_Esti(2,100)[1], MSE_Esti(3,100)[1], MSE_Es
ti(5,100)[1], MSE_Esti(10,100)[1], MSE_Esti(30,100)[1]), type="b", col="red", main="For theta = 1
00", xlab="theta", ylab="MSE")
> lines(c(1, 2, 3, 5, 10, 30), c(MSE_Esti(1,100)[2], MSE_Esti(2,100)[2], MSE_Esti(3,100)[2], MSE_
Esti(5,100)[2], MSE_Esti(10,100)[2], MSE_Esti(30,100)[2]), type="b", col="blue")
> legend("bottomright", legend = c("MLE", "MOM"), text.col = c("red", "blue"))
>
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